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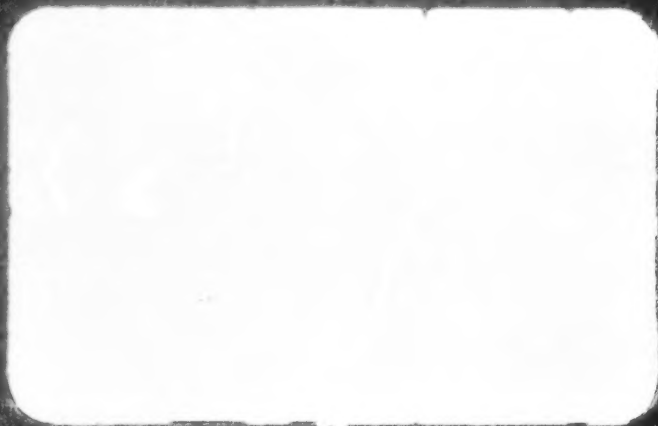
ABSTRACT

As part of an evaluation study of the Berkeley Unified School District, this impact study was undertaken to determine the effectiveness of the district, schools, and programs in terms of basic skill achievement and to determine the relationship of specified educational variables (such as instruction, staffing, and school attributes, and of student variables such as sex, age, race, or ability) to basic skill achievement. The quantifiable dependent variables which measure impact were used in comparisons between levels of specified independent variables (e.g., instruction, staff to student ratio, student characteristics, school program, etc.) to indicate associations with student achievement. School effectiveness was assessed by measuring change in student achievement in reading and mathematics during the 1974-75 school year. Utilizing district test scores, measures of gain were computed for each school and program and these were compared with mean gains for all other schools to measure relative achievement of each school and program. To determine the relationship of specified educational and student variables to basic skill achievement, California Tests of Basic Skills reading and math scale scores were analyzed in relation to each of the specified independent variables so that the amount of variance could be quantitatively established. Specific strategies and results obtained are reported in detail. (RC)

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BERKELEY UNIFIED SCHOOL DISTRICT
EVALUATION STUDY

FINAL REPORT
VOLUME III

BEST COPY AVAILABLE

October, 1975

VOLUME III
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IMPACT STUDY

Introduction and Overview of the Analytic
Approach

Reading and Mathematics Achievement in
B.U.S.D.: School Effectiveness Study

Impact of Student, Classroom, and School
Variables on Achievement: Educational
Impact Study

V. IMPACT STUDY

Introduction and Overview of the Analytic Approach

In January, 1975, Pacific Consultants began work under a contract with the Berkeley Unified School District (B.U.S.D.) to conduct a district-wide evaluation study. Through two major research components, a process study and an impact study, each of which had specific research questions and activities, the evaluation study sought to fulfill three primary objectives: 1) to document, describe, and assess the current school system; 2) to determine the effectiveness of the current school system; and 3) to identify effective educational factors.

The process study, reported in Volumes I and II, documents and describes curriculum, instructional methodology, teacher-student-parent attitudes, and staffing patterns as required by the first objective of the evaluation study.

The impact study, reported in this volume, addresses the second and third objectives.

- School Effectiveness Study -- Objective 2, as stated above, requires the determination of the effectiveness of the district, schools and programs in terms of basic school achievement. "Basic school achievement" was defined as the change in student achievement in reading and mathematics during the 1974-75

school year. Utilizing test scores supplied by the district, measures of gain were derived for every individual who had both a fall and spring test score. Mean gain scores were then computed for each school and program and these were compared with the mean gains for all other schools serving the same grades in order to measure the relative achievement of each school and program. The specific strategies and results of this study are reported in Section 2 of this volume.

- Educational Impact Study -- Objective 3 requires a determination of the *relationship* of specified educational and student variables to basic skill achievement. In order to determine this relationship, Spring, 1975, CTBS reading and math scale scores were used as the measure of achievement. These scores (the dependent variable) were analyzed in relation to each of the specified independent variables so that the amount of variance attributable to each independent variable could be quantitatively established. The specific analytic strategies and results obtained in determining the impact of classroom process variables on achievement are reported in Section 3 of this volume.

- Analytic Approach -- While the school effectiveness study and the study of the impact of classroom variables were conducted separately, the basic analytic methodology was similar. In both instances, a regression model was utilized.

In the analysis of school effectiveness, a regression model was used to generate measures of student achievement that controlled for student differences (i.e., residual gain scores) so that the school's effectiveness could be measured. In the impact analysis a regression model was used to examine the extent to which classroom variables explained student achievement. For both the achievement and impact studies, the dependent variables were the spring 1975 CTBS reading and math scale scores. These scores were predicted on the basis of students' "skill," as measured by the fall 1974 CTBS scores, on the student's grade, sex, and ethnicity, and on the interactions between these variables. The use of the regression model allowed for the control of student characteristics and skills before evaluating the effect of school and classroom.

- General Model -- In a regression model, the dependent variable, y , here the spring score, is predicted on the basis of a number, k , of independent variables,

$x_1, x_2, \dots, x_k$, by an equation of the form:

$$y' = b_0 + b_1x_1 + b_2x_2 + \dots + b_kx_k$$

where y' represents the predicted or estimated value for y , and the b 's are the regression coefficients.

By definition, these b 's are selected so that the sum of squared residuals, $\sum (y - y')^2$ is as small as possible; i.e., any other choice of b 's would make $\sum (y - y')^2$ larger.

While it is not assumed that the independent variables (the x 's) are statistically independent or uncorrelated, it is assumed that the effects of the x 's on y are additive. This means that the relationship between the dependent variable, y , and any of the independent variables, x , is the same for all values of the other x 's; i.e., that there is no interaction between the x 's. When this assumption is unwarranted, interaction variables can be included in the regression model. If, for example, x_1 and x_2 are the independent variables and interaction is assumed, the model could be written:

$$y' = b_0 + b_1x_1 + b_2x_2 + b_3x_1x_2$$

As suggested by the notation, the interaction variable is created by multiplying x_1 scores by corresponding x_2 scores. The hypothesis that there is no interaction could be tested as $H: b_3 = 0$. The model will still be additive in form, but the multi-

plicative term represents the joint effect of x_1 and x_2 over and above that of x_1 and x_2 as a sum.

For each nominal-scale variable such as ethnicity and sex, where the response is simply an arbitrary code (e.g., -3 = male, .7 = female), a set of dummy variables is created by using each response category of the nominal variable as a separate variable and assigning a score to each on the presence or absence of each response. Sex, for example, would be transformed to a variable with the value 1 if the student is female and 0 if the student is not female. In the analysis this was done for the variables of ethnicity, sex, and Model of Individualization.

- Data Generation -- The analyses of both school effectiveness and educational impact were based on fall 1974 and spring 1975 test data provided by B.U.S.D. A common data set was generated from these test scores which was used in both the analyses. The specific processes utilized in generating the common data set are described below.

First, based on a tape of fall 1974/spring 1975 test scores supplied by B.U.S.D., students were selected for inclusion in the data set if the data furnished indicated that the student had taken a CTBS test in both the fall and spring. Since the analysis

was to be based on fall-to-spring achievement measures, students who lacked either a fall or spring score could not be included. The sample below demonstrates this selection process:

	Student	Fall CTBS		Spring CTBS	
		Reading	Math	Reading	Math
Included	A	x	x	x	x
	B	x	x	x	
	C	x	x		x
	D	x		x	x
	E		x	x	x
	F	x			x
	G		x		x
Excluded	H	x	x		
	J			x	x
	K	x	x		
	L			x	
	M	x			

As shown in the foregoing sample, students A through G were included since they met the criteria of having reading and/or math scores for both spring and fall. It will be noted that some of the included students were missing one or more of the desired scores (e.g., Student D had no fall math score, Student F had no fall math and no spring reading

reading scores, and Student G had no reading score for either fall or spring). While these students were included in the data set, the missing scores account for the reported variations in total numbers: thus, for example, a student may be included in computing a reading mean for spring or fall if he has either score, but he will not be included in the computation of gain unless he has both spring and fall reading scores.

Students H through L were not included, since no fall-spring comparisons could be made in either reading or math. The implications of this necessary de-selection are of great importance, since it means that those schools and classrooms for which we received spring or fall scores, but not both, are underrepresented in both the data set and the analysis based on the data set.

Further, it will be noted that only students having CTBS test scores are included. In some instances, other tests were utilized (e.g., the Boehm in Kindergarten and the COOP in grades 11 and 12). While some special studies were conducted on the basis of these tests, the scale scores of the Boehm and COOP are not comparable with CTBS scores, so the students who took these tests in lieu of the CTBS had to be excluded from the basic data set and hence from the analysis. The maximum possible loss of subjects from this source

is approximately 1200 students. Altogether, 8187 students met the criteria for inclusion. Of the 8187, 75 students were found to have two records, and one record for each of those 75 students was arbitrarily eliminated, resulting in an unduplicated count of 8112.

Third; after the selection of students for inclusion had been completed, the raw scores for total reading and total math were converted to scale scores, and the student's grade, school, location within school, sex, and ethnicity were included in the record.

Fourth, for elementary students, if the spring location and school indicated that the student was in a classroom observed by Pacific Consultants, the values of the classroom variables were included in the student's record. Classroom variables used were the I-Scale score, Model of Individualization, and Teacher Survey - Part II results (DISC total and Items 29 to 32). Finally, participation of a student in an Experimental School Program was recorded.

The generated data set which provided the basis for both analytic studies consisted of 8112 unduplicated records comprised of: fall and spring CTBS scale scores in reading and/or math; student characteristics; grade, school, and program identifiers; and classroom characteristics.

- Data Description -- Tables 121 to 127 permit an examination of the condition of the generated data set. The properties of this data set conform with reasonable expectations. Table 121 presents a summary of statistics for fall and spring scale scores and the raw gain scores (spring score minus fall score) for those students that have both. Scale scores are expected to go up with grade, and the elimination of grades eleven and twelve suggests that mean scores below the national norm of 500 should be expected. The standard deviations are larger than expected (100), and this and the range on the gain scores suggests that some additional score editing and censoring could have been done. As Pacific Consultants was not familiar with the complete processing and history of the data, however, it was used as supplied by B.U.S.D.

Tables 122 to 127 break out the data contained within Table 121 on a grade basis. Tenth grade means are approximately one standard deviation below the national norms, but, as will be shown, these figures are based on a non-representative sample and are therefore not indicative of performance by tenth grade students as a whole. For all other grades, spring norms are slightly above the national norms in both reading and math. This is consistent with district findings as presented in district reports and

Table 121. Summary Test Statistics for Student Records Selected for the Impact Analysis.

VARIABLE	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM**	MAXIMUM**	NUMBER OF OBSERVATIONS
Fall Reading Scale Score	464	141	1.73	157	990	6518*
Fall Math Scale Score	407	134	1.58	134	908	7248
Spring Reading Scale Score	474	145	1.69	18	982	7264*
Spring Math Scale Score	445	128	1.51	146	886	7217
Reading Raw Gain	35	62	0.79	-927	388	6095*
Math Raw Gain	40	50	0.61	-511	463	6704

*Internal differences reflect the presence or absence of a particular test (e.g., there were 6518 fall reading scores and 7264 spring reading scores on the generated data set; these included 6095 who had both fall and spring reading scores).

**Minimums and maximums reflect the lowest and highest scores of individual students.

Table 122. Fall Reading Scale Score By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N
TOTAL	464.0259	141.2206	19943.2500	(6518)
1.	289.433	41.766	1744.436	(127)
2.	310.193	56.589	3202.308	(715)
3.	367.482	74.905	5610.707	(790)
4.	405.355	91.545	8380.527	(706)
5.	442.912	101.533	10308.941	(797)
6.	495.808	105.424	11114.168	(860)
7.	529.307	124.269	15442.668	(912)
8.	574.103	130.728	17089.922	(774)
9.	606.568	138.167	19090.004	(623)
10.	491.173	104.671	10956.016	(214)

TOTAL CASES = 8112

MISSING CASES = 1594 OR 19.6 PCT.

Table 123. Fall Math Scale Score By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N
TOTAL	407.5090	134.3921	18061.2266	(7248)
1.	237.362	32.591	1062.151	(810)
2.	284.297	39.611	1569.065	(842)
3.	329.176	48.686	2370.308	(805)
4.	369.326	62.158	3863.662	(663)
5.	396.773	77.076	5940.762	(666)
6.	458.794	86.661	7510.062	(803)
7.	483.437	103.688	10751.160	(917)
8.	528.672	117.312	13762.215	(788)
9.	565.383	127.283	16201.004	(724)
10.	481.767	75.791	5744.211	(228)
TOTAL CASES = 8112				
MISSING CASES = 364 OR 10.7 PCT.				

Table 124. Spring Reading Scale Score By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N
TOTAL	474.8711	144.9523	21011.1719	(7264)
1.	288.394	39.489	1559.397	(810)
2.	359.293	58.514	3423.903	(829)
3.	425.175	90.712	8228.652	(802)
4.	449.062	93.362	8716.496	(686)
5.	493.893	102.159	10436.402	(804)
6.	532.561	107.382	11530.941	(849)
7.	536.531	128.185	16431.512	(888)
8.	576.696	133.928	17936.637	(777)
9.	636.807	154.481	23864.496	(611)
10.	512.864	100.325	10065.168	(206)

TOTAL CASES = 8112

MISSING CASES = 848 OR 10.5 PCT.

Table 125. Spring Math Scale Score By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N
TOTAL	445.1790	128.1501	16422.4531	(7217)
1.	286.425	37.103	1376.649	(814)
2.	336.922	38.801	1505.482	(843)
3.	385.528	57.953	3358.521	(791)
4.	403.300	54.890	3012.900	(690)
5.	465.635	86.215	7433.059	(817)
6.	499.612	94.853	8997.148	(840)
7.	508.740	117.781	13872.324	(884)
8.	541.068	117.142	13722.187	(761)
9.	600.516	130.188	16948.926	(634)
10.	494.057	76.981	5926.055	(141)

TOTAL CASES = 8112

MISSING CASES = 895 OR 11.0 PCT.

Table 126. Raw Gain Reading By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N
TOTAL	35.0023	60.7068	3685.3140	(6095)
1.	34.656	32.023	1025.502	(125)
2.	57.328	38.394	1474.078	(707)
3.	62.144	46.925	2201.995	(759)
4.	43.692	56.807	3226.985	(665)
5.	49.323	62.536	3910.779	(734)
6.	36.836	43.086	1856.373	(819)
7.	6.834	55.944	3129.724	(860)
8.	1.659	55.122	3038.478	(736)
9.	29.076	95.858	9188.699	(536)
10.	20.773	62.109	3857.510	(154)
TOTAL CASES = 8112				
MISSING CASES = 2017 OR 24.9 PCT.				

Table 127. Raw Gain Math By Grade.

GRADE	MEAN	STD DEV	VARIANCE	N*
TOTAL	39.9533	49.5511	2455.3093	(6704)
1.	49.240	29.736	884.244	(795)
2.	52.449	27.139	736.535	(838)
3.	55.235	35.238	1241.687	(767)
4.	33.311	41.536	1725.208	(631)
5.	65.820	73.102	5343.918	(623)
6.	42.692	52.104	2714.842	(760)
7.	25.302	50.828	2583.479	(857)
8.	11.420	46.227	2136.947	(735)
9.	26.094	53.734	2887.368	(588)
10.	22.148	67.203	4516.238	(108)

TOTAL CASES = 8112

MISSING CASES = 1408 OR 17.4 PCT.

cited on page 27 of Volume I of this report. The consistency between district findings and those shown in the accompanying table supports the assumption that the data upon which the present study is based are representative of the available data.

- Research Limitations and Constraints -- A review of the foregoing grade tables adds considerably to our understanding of the quality and limitations of the data. In general (i.e., with the exception of the number of fall scores for first grade reading), there appears to be an adequate representation of all of the grades from first through ninth, in both reading and math. As noted earlier, Kindergarten was excluded because of the use of the Boehm instead of the CTBS, and grades eleven and twelve were excluded because of the use of the COOP test. Grade ten is also grossly under-represented in our data because of the mixed use of CTBS and COOP. As will be shown below, the CTBS scores we do have for the tenth grade are in no way representative of the students in that grade.

Because of the importance of examining high school data, COOP test results from spring 1975 were separately examined and are presented in Table 128. It appears that the mean scores are close to the national norms, with the exception of the geometry results, which are a little low.

Table 128. Spring 1975 Cooperative English and Cooperative Math Results by Grade Grouping.

	GRADE 10			GRADE 11			GRADE 12		
	M	SD	N*	M	SD	N	M	SD	N
Reading (Total)	156.0	10.55	465	157.3	11.92	371	154.4	11.97	15
English (Total)	153.9	10.89	431	154.9	12.68	353	152.8	10.02	12
Trigonometry	--	--	--	154.6	9.67	41	149.9	10.06	21
Analytic Geometry	174	8.72	4	163.2	5.56	12	160.2	8.14	24
Calculus	--	--	--	144	4.44	9	144.1	4.59	11
Geometry	140.1	7.13	131	135.9	5.0	62	132.3	6.31	11

*For purposes of this special study, all spring scores were included, whether or not a fall score was available.

The most relevant aspect of this sub-study, however, was uncovered by an examination of the COOP results for consistency and bias; namely, it was found that ethnicity makes a highly significant difference in which test a student was given. The distribution is presented in Table 129, based on a comparison of students who took fall and spring CTBS tests and those who took fall and spring COOP tests.

Table 129. Distribution of High School Tests by Ethnicity

ETHNIC GROUP	COOP		CTBS	
	N	Percent	N	Percent
American Indian	1	.1	0	0.0
Asian	124	11.2	13	2.4
Black	325	29.2	437	79.9
Chicano	21	1.9	21	3.8
Other	25	2.3	10	1.8
White	613	55.3	66	12.1

It will be seen that a total of 55% of the students taking the COOP tests were White, while 12% of the students taking the CTBS were White. A total of 29% of the students taking the COOP tests were Black, while 80% of the students taking the CTBS test were Black. Since the COOP test is generally administered to higher achieving students, these results may seem

to be a direct reflection of the student tracking patterns identified in the course of the process study. The results suggest that any comparison of B.U.S.D. to external norms for grades ten to twelve is invalid.

The data were also examined from the standpoint of school-by-school representation. Table 130 presents the extent to which fall and spring test data were provided, by school. K-through-3 schools were expected to have somewhat fewer scores because of the exclusion of Kindergarten children; within these schools, Hillside, Whittier and LeMonte are the most poorly represented, suggesting some inadequacies in the completeness of their testing programs. 4-6 schools and 7-9 schools (except Odyssey) are generally well represented, with all schools achieving 75% or better. However, it is apparent that several schools are very poorly represented in the data: Berkeley High has only 18% participation, which was anticipated in view of the fact that most students at that site are not given the CTBS. Kilimanjaro has only 13%, Odyssey 18%, and East Campus, 39%. In these instances, it is apparent that the district's expectation that a systematic testing program would be conducted was not fulfilled.

While the reasons for poor representation were not thoroughly examined, several aspects of the

Table 130. Extent of Participation by School.

School	Attendance 2/75	Number Records Generated	Percent of 2/75 Attendance
Tilden	121	82	68
Cragmont	421	274	65
Emerson	343	212	62
Grizzly Peak	116	73	63
Hillside	307	151	49
Jefferson	483	279	58
John Muir	477	281	59
Le Conte	322	169	52
Oxford	298	173	58
Thousand Oaks	512	290	57
Washington	454	284	63
Whittier	400	219	55
Columbus	555	484	87
Franklin	946	761	80
Malcolm X	690	516	75
Longfellow	890	722	81
Martin L. King	1218	1055	87
Willard	835	698	84
West Campus	992	783	79
East Campus	200	77	39
Berkeley High	2709	476	18
Kilimanjaro	70	9	13
Early Learning Ctr.	46	24	52
Odyssey	104	21	21

problem were. The poor participation of some schools may have been atypical due to problems with the fall 1974 testing program. Certainly the percentage participation for spring testing appeared much higher whenever this was examined, but the examination did not show that this would affect the analysis: e.g., 21 students from Odyssey have both fall and spring test results, while 40 students took the spring test only. Statistical testing between these groups showed no statistical differences, though for most sub-groups the students who took both tests have higher mean scores.

In general, participation of ESP schools and classrooms in achievement testing was poor; this appears to be systemic and is consistent with our difficulty in collecting teacher surveys and process data and with anecdotes furnished by the District evaluation office. It has made ESP evaluation very difficult, and certainly not definitive.

Reading and Mathematics Achievement in B.U.S.D.: School Effectiveness Study

- Analytic Approach -- The purpose of this analysis was to determine whether and to what extent mean student achievement differed in the different schools or programs. In order to make this determination, a measure of student achievement was constructed and a One-Way Analysis of Variance was performed to see if mean achievement differed significantly by school or program.

The first measure of achievement used was the raw gain from fall to spring testing for reading and for math. The limitation of this measure, raw gain, is that it does not allow for differences in students that may make a difference in achievement. If, for example, females tend to gain more than males, a girls' school will be expected to have higher gain than a boys' school, and the differences will reflect the students and not the school.

Due to the limitation of raw gain scores described above, a residual gain score measure of achievement was also used (e.g., Cronbach & Furby, 1970). For this measure, a regression model was used to predict spring test scores on the basis of fall scores, grade, sex, ethnicity, and interactions between grade, ethnicity and fall test scores. The

predicted value for the student represents the expected score, given the student's characteristics and fall scores. The residual gain score, the observed spring score minus the predicted score, represents the student's gain which is not accounted for by the regression model. This residual gain is then used as the measure of student achievement (achievement after adjusting for past performance and student characteristics).

The coefficients of the equations used to predict achievement are presented in Tables 131 and 132. On the basis of preliminary analysis of approximately 6,000 scores, variables which were clearly not predictive were eliminated. To prevent school/grade interaction (not all schools enroll all grades), and to reduce the score variation due to grade, separate models were used for each grade group (1-3, 4-6, 7-9, 10). When examining the equations in Tables 131 and 132, it should be recalled that the expected increase in score with grade can be accounted for by the fall test scores (which also increase with grade) or within the fall score/grade interaction. Hence, a positive coefficient for grade is not necessarily expected.

Table 131. Equations for Residual Gain Measures in Reading.

Variable	Grades 1-3	Grades 4-6	Grades 7-9	Grade 10
B ₀ Constant	246.411	205.585	.594	104.316
B ₁ Fall Reading - READ1	.221	.545	.814	.818
B ₂ Grade - GRADE	-55.988	-18.539	7.756	---
B ₃ Ethnicity (White) - DRACE1	66.067	117.256	70.881	52.525
B ₄ Ethnicity (Black) - DRACE2	-12.740	-12.684	-6.828	5.133
B ₅ White/Fall Score - RREAD1	-.133	-.193	-.092	-.044
B ₆ Grade/Fall Score - GRADER	.249	.058	.011	---

Table 132. Equations for Residual Gain Measures in Math.

Variable	Grades 1-3	Grades 4-6	Grades 7-9	Grade 10
B ₀ Constant	150.841	310.600	-27.311	213.576
B ₁ Fall Math - MATH1	.554	.136	1.052	.551
B ₂ Grade - GRADE	-6.002	-21.450	13.749	---
B ₃ Ethnicity (White) - DRACE1	-10.972	30.101	21.716	23.223
B ₄ Ethnicity (Black) - DRACE2	-15.953	-31.812	-28.066	22.326
B ₅ White/Fall Score - RMATH1	.040	-.051	-.041	.069
B ₆ Grade/Fall Score - GRADEM	.077	.100	-.018	---

Summary statistics for the residual gain scores are presented in Table 133. Because of the nature of a regression model, the mean for each grade group should be zero. The standard deviation in Table 133 should be noted, however, when considering the differences reported in the next section.

Table 133. Summary Statistics for Residual Gain Measures.

Variable	Mean	Standard Deviation	Standard Error	Minimum	Maximum	Number of Observations
Residual Gain Reading - Grades 1-3	-0.06	38.45	0.96	-143.39	146.09	1591
Residual Gain Math - Grades 1-3	-0.09	29.01	0.59	-147.27	116.16	2402
Residual Gain Reading - Grades 4-6	-0.01	49.32	1.05	-190.17	294.10	2218
Residual Gain Math - Grades 4-6	0.50	52.83	1.18	-170.64	331.22	2014
Residual Gain Reading - Grades 7-9	1.57	69.40	1.50	-899.12	232.02	2132
Residual Gain Math - Grades 7-9	-1.47	50.66	1.08	-520.12	247.21	2190
Residual Gain Reading - Grade 10	0.08	59.32	4.78	-218.53	200.70	154
Residual Gain Math - Grade 10	-0.11	59.83	5.76	-126.93	371.19	108

Table 134 presents the number of students in the achievement analysis by school. Losses may be due to missing test data (either fall or spring) or due to missing student variables in the regression analysis. Since the numbers for the residual and raw gain measures are the same, all losses are due to missing test scores. The losses, while substantial in some schools, were not considered large enough to adversely affect the analysis except in the tenth grade schools. In this case, since East Campus and Berkeley High School losses were of comparable magnitude and since no claim was made to us as to the representativeness of the Berkeley High School sample, the analysis was done.

- Results -- The results of the achievement analysis are presented in Tables 135 to 140. Results are summarized in Tables 135 and 136 and are presented in detail in Tables 137 to 140. Schools within each grade group are compared with each other by comparing the mean for each school with the mean for the school's grade group on each of the four achievement studies: raw gain reading, raw gain math, residual gain reading, and residual gain math.

Statistically significant differences between schools were found in all grade groupings, with the

Table 134. Participation in the Analysis by School.

School	Number Records Generated	Number in Analysis	
		Reading	Math
Tilden	82	74	82
Cragmont	274	155	272
Emerson	212	145	208
Grizzly Peak	73	44	62
Hillside	151	84	133
Jefferson	279	220	271
John Muir	281	174	274
Le Conte	169	97	159
Oxford	173	111	154
Thousand Oaks	290	170	286
Washington	284	160	271
Whittier	219	144	204
Columbus	484	426	409
Franklin	761	666	506
Malcolm X	516	449	445
Longfellow	722	672	650
Martin L. King	1055	946	960
Willard	698	644	624
West Campus	783	522	584
East Campus	77	20	12
Berkeley High	476	134	96
Kilimanjaro	9	7	8
Early Learning Center	24	11	22
Odyssey	21	16	7

exception of the tenth grade. Differences were characterized as "statistically significant" if they were significant at the .05 level, based on the F-test (i.e., if the probability that the computed F-ratio was due to sampling variation was less than .05).

Schools that are different, either above or below the others in their grade group, are listed in Tables 135 and 136. These schools were selected on the basis of the statistical analysis shown in Tables 137 to 140. In these tables, a 95% confidence interval for the school means is computed. It is expected that 95% of the time such an interval will cover (include) the true mean for the school. A school is identified as above others in its grade group if the lower limit of the 95% confidence interval for the school mean is above the group mean for the measure. In the 1-3 grade group, for example, the mean raw gain reading is 57.8. Since the 95% confidence interval for John Muir is (62.95, 76.22) and 62.95 is greater than 57.8, John Muir is listed as an above-average school on raw gain reading. Likewise, a school is identified as below others in its grade group if the upper limit of the 95% confidence interval for the school mean is below the group means for the measure.

In grade group 1-3, Tilden and Washington are

Table 135. Schools Scoring Significantly Above the Average of Their Respective Grade Groupings.

Grade Grouping	Reading		Math	
	Raw Gain	Residual Gain	Raw Gain	Residual Gain
Grades 1-3	John Muir Washington	Tilden John Muir Emerson	Tilden Washington Early Learning	Tilden Washington Early Learning Thousand Oaks
Grades 4-6	Columbus	Columbus	Columbus	None
Grades 7-9	West Campus	West Campus	West Campus	West Campus
Grade 10	None	None	None	None

Table 136. Schools Scoring Significantly Below the Average of Their Respective Grade Groupings.

Grade Grouping	Reading		Math	
	Raw Gain	Residual Gain	Raw Gain	Residual Gain
Grades 1-3	Le Conte Cragmont Thousand Oaks Jefferson	Le Conte Cragmont Thousand Oaks	Le Conte Whittier Grizzly Peak	Le Conte Whittier Grizzly Peak
Grades 4-6	Franklin Malcolm X	Franklin Malcolm X	Kilimanjaro	None
Grades 7-9	Odyssey Willard Martin L. King	Odyssey Willard	Willard	Willard
Grade 10	None	None	None	None

above average on most measures. John Muir is above average in reading, and Washington and Early Learning Center are above average in math. Le Conte is below average on all measures. Cragmont and Thousand Oaks are below average on reading. Whittier and Grizzly Peak are below average on the math measures.

In grades four to six, Columbus is above average on math measures, and Franklin and Malcolm X are below average on the reading measures. The residual gain math measure shows no significant differences in schools.

In grade group 7-9, West Campus was significantly above average on all measures, and Willard was below average on all measures. While some of the achievement of West Campus may be due to the fact that it is a ninth grade school (and that the gain measures have not completely adjusted for grade), West Campus is clearly superior. The very small gains evidenced by the 7th and 8th grade schools suggest that additional investigation of the reasons for this finding at these schools would be desirable.

In grade ten, there were no significant differences between East Campus and Berkeley High School despite the means being lower for East Campus on all measures. This should not be interpreted as meaning that East Campus is doing as well as Berkeley High School, but that East Campus students are doing as

Table 137-a. Reading Achievement by School for Grades One to Three.

Raw Gain Reading					95 PCT CONF INT FOR MEAN				
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM			
EARLY LRNG	11	75.7273	30.6075	9.2285	39.0000	139.0000	55.1649	TO	96.2896
TILDEN	74	66.9730	39.9236	4.6410	-16.0000	144.0000	57.7234	TO	76.2225
CRAIGMONT	155	46.7484	43.8776	3.5243	-70.0000	205.0000	39.7861	TO	53.7106
EMERSON	145	64.4138	44.6028	3.7041	-54.0000	186.0000	57.0924	TO	71.7351
GRIZZLEY PK	44	64.3636	47.0280	7.0897	-18.0000	168.0000	50.0658	TO	78.6614
HILLSIDE	84	53.8452	45.3231	4.9452	-135.0000	165.0000	44.0035	TO	63.6809
JEFFERSON	220	50.6682	38.0902	2.5680	-62.0000	195.0000	45.6069	TO	55.7294
JOHN NUIR	174	69.5862	44.3463	3.3619	-67.0000	191.0000	62.9506	TO	76.2218
LE CONTE	97	43.6392	35.0438	3.5582	-62.0000	128.0000	36.5763	TO	50.7020
OXFORD	111	61.9640	45.2309	4.2931	-15.0000	200.0000	53.4560	TO	70.4719
THOUS OAKS	170	48.1470	35.5773	2.7297	-102.0000	137.0000	42.7604	TO	53.5337
WASHINGTON	160	70.5000	46.6383	3.6871	-84.0000	230.0000	63.2180	TO	77.7820
WHITTIER	144	56.6944	39.9707	3.3309	-86.0000	169.0000	50.1103	TO	63.2786
KILIMANJARO	2	152.5000	16.2635	11.5000	141.0000	164.0000	6.3787	TO	298.6211
TOTAL	1591	57.8441	42.8424	1.0741	-135.0000	230.0000	55.7373	TO	59.9509
Residual Gain Reading					95 PCT CONF INT FOR MEAN				
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM			
EARLY LRNG	11	9.6146	30.7966	9.2855	-27.2466	59.1760	-11.0748	TO	30.3040
TILDEN	74	8.8970	32.2427	3.7481	-76.8784	68.1367	1.4270	TO	16.3670
CRAIGMONT	155	-8.2915	37.4327	3.0067	-109.6624	129.1865	-14.2311	TO	-2.3519
EMERSON	145	6.8332	41.1783	3.4197	-111.0349	100.4514	0.0739	TO	13.5924
GRIZZLEY PK	44	1.1428	47.0164	7.0880	-80.5879	101.9219	-13.1515	TO	15.4371
HILLSIDE	84	-7.6014	37.1105	4.0491	-97.7468	80.6221	-15.6549	TO	0.4521
JEFFERSON	220	-3.2964	37.6691	2.5396	-121.9268	135.5015	-8.3016	TO	1.7089
JOHN NUIR	174	8.5178	40.3464	3.0587	-116.1968	121.1267	2.4807	TO	14.5549
LE CONTE	97	-7.9944	32.6162	3.3117	-108.9487	75.2532	-14.5880	TO	-1.4209
OXFORD	111	5.2059	35.9872	3.4158	-59.6899	132.6016	-1.5633	TO	11.9751
THOUS OAKS	170	-4.8525	30.2757	2.3220	-131.2820	62.4482	-9.4364	TO	-0.2685
WASHINGTON	160	3.2770	44.4405	3.5133	-138.9229	146.0913	-3.6618	TO	10.2158
WHITTIER	144	-2.9335	38.5192	3.2099	-143.3867	116.6055	-9.2785	TO	3.4116
KILIMANJARO	2	94.3771	13.2765	9.3879	84.9893	103.7650	-24.9075	TO	213.6618
TOTAL	1591	-0.0587	38.4538	0.9641	-143.3867	146.0913	-1.9497	TO	1.8322

Table 137-b. Mathematics Achievement by School for Grades One to Three.

Raw Gain Math					95 PCT CONF INT FOR MEAN				
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT	FOR MEAN
EARLY LRNG	22	70.9091	27.8225	5.9318	25.0000	160.0000	58.5733	TO	83.2449
TILDEN	82	64.1341	31.1039	3.4348	11.0000	152.0000	57.2999	TO	70.9684
CRAGMONT	272	50.2463	27.9549	1.6950	-46.0000	139.0000	46.9092	TO	53.5834
EMERSON	208	53.6971	26.9804	1.8708	-35.0000	140.0000	50.0089	TO	57.3853
GRIZZLEY PK	62	42.6613	29.5934	3.7584	-29.0000	125.0000	35.1460	TO	50.1766
HILLSIDE	133	48.5113	30.4441	2.6398	-37.0000	128.0000	43.2894	TO	53.7331
JEFFERSON	271	53.6125	28.0963	1.7067	-44.0000	141.0000	50.2523	TO	56.9727
JOHN MUIR	274	54.8102	29.8033	1.8005	-43.0000	166.0000	51.2656	TO	58.3348
LE CONTE	159	43.6163	30.7340	2.4374	-91.0000	129.0000	38.8023	TO	48.4304
OXFORD	154	51.2338	35.8987	2.8928	-28.0000	185.0000	45.5188	TO	56.9487
THOUS OAKS	286	54.4685	28.5648	1.6891	-45.0000	155.0000	51.1439	TO	57.7932
WASHINGTON	271	62.4096	32.1726	1.9543	-13.0000	172.0000	58.5619	TO	66.2573
WHITTIER	204	38.1029	32.9061	2.3039	-108.0000	132.0000	33.5603	TO	42.6455
KILINANJARO	4	43.7500	36.9087	18.4543	-3.0000	87.0000	-14.9790	TO	102.4790
TOTAL	2402	52.2744	30.8423	0.6293	-108.0000	185.0000	51.0403	TO	53.5084

Residual Gain Math					95 PCT CONF INT FOR MEAN				
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT	FOR MEAN
EARLY LRNG	22	17.2714	25.6908	5.4773	-26.5095	93.2622	5.8807	TO	28.6620
TILDEN	82	13.5366	28.2457	3.1192	-44.7373	94.1877	7.3304	TO	19.7429
CRAGMONT	272	-2.1592	26.9658	1.6350	-97.7649	78.2126	-5.3782	TO	1.0598
EMERSON	208	3.0714	24.3647	1.6894	-70.8264	68.7122	-0.2592	TO	6.4020
GRIZZLEY PK	62	-10.2772	29.1329	3.6999	-94.3689	69.1128	-17.6756	TO	-2.8788
HILLSIDE	133	-3.2812	28.7327	2.4914	-80.1008	74.3877	-8.2095	TO	1.6471
JEFFERSON	271	0.3816	27.3339	1.6604	-78.2129	85.7805	-2.8874	TO	3.6506
JOHN MUIR	274	2.1980	27.2574	1.8467	-76.4309	98.2122	-1.0438	TO	5.4398
LE CONTE	159	-6.8549	31.9526	2.5340	-146.8938	74.6641	-11.8597	TO	-1.8500
OXFORD	154	-1.2663	32.5328	2.8232	-71.1008	116.1621	-6.4486	TO	3.9160
THOUS OAKS	286	3.5234	25.5082	1.5083	-111.3999	89.4961	0.5545	TO	6.4922
WASHINGTON	271	6.5070	30.0595	1.8260	-80.5129	91.9932	2.9120	TO	10.1019
WHITTIER	204	-13.7819	31.7583	1.8260	-147.2666	78.7156	-18.1661	TO	-9.3978
KILINANJARO	4	-15.5463	30.7562	15.3781	-54.5217	28.2131	-64.4855	TO	33.3929
TOTAL	2402	-0.0891	29.0109	0.5919	-147.2666	116.1621	-1.2498	TO	1.0717

Table 138. Reading and Mathematics Achievement by School for Grades Four to Six.

Raw Gain Reading				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT. CONF. INT. FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION					
KILIMANJARO	5	21.8000	46.3918	20.7470	-58.0000	52.0000	-35.8021	TO 79.4021
COLUMBUS	426	63.8098	77.0306	3.7321	-115.0000	367.0000	56.4741	TO 71.1456
FRANKLIN	666	36.9579	42.7391	1.6561	-85.0000	286.0000	33.7061	TO 40.2098
MALCOLM X	449	35.5100	50.9055	2.4024	-183.0000	388.0000	30.7887	TO 40.2313
LONGFELLOW	672	41.0372	46.3851	1.7893	-194.0000	252.0000	37.5238	TO 44.5506
TOTAL	2218	43.0239	54.5147	1.1575	-194.0000	388.0000	40.7539	TO 45.2939
Residual Gain Reading				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT. CONF. INT. FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION					
KILIMANJARO	5	-15.5119	28.0544	12.5463	-54.1726	22.3354	-50.3454	TO 19.3216
COLUMBUS	426	14.3240	65.2969	3.1636	-155.3105	294.1050	8.1057	TO 20.5424
FRANKLIN	666	-5.0220	41.0605	1.5911	-126.6580	189.7463	-8.1461	TO -1.8979
MALCOLM X	449	-4.9877	47.3559	2.2349	-188.3247	262.7483	-9.3798	TO -0.5955
LONGFELLOW	672	-0.6983	44.6093	1.7208	-190.1726	193.0693	-4.0772	TO 2.6806
TOTAL	2218	-0.0130	49.3221	1.0473	-190.1726	294.1050	-2.0668	TO 2.0407
Raw Gain Math				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT. CONF. INT. FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION					
KILIMANJARO	4	3.7500	12.3390	6.1695	-5.0000	22.0000	-15.8837	TO 23.3837
COLUMBUS	409	57.4719	76.4799	3.7817	-109.0000	463.0000	50.0379	TO 64.9059
FRANKLIN	506	43.6423	55.0545	2.4475	-140.0000	392.0000	38.8338	TO 48.4507
MALCOLM X	445	46.1708	59.0691	2.8001	-94.0000	347.0000	40.6676	TO 51.6740
LONGFELLOW	650	43.5708	44.6116	1.7498	-168.0000	218.0000	40.1348	TO 47.0067
TOTAL	2014	46.9071	58.2250	1.2974	-168.0000	463.0000	44.3627	TO 49.4515
Residual Gain Math				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT. CONF. INT. FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION					
KILIMANJARO	4	-28.7166	32.1123	16.0561	-69.1306	3.6294	-79.8136	TO 22.3805
COLUMBUS	409	5.9000	64.4895	3.1888	-152.9697	331.2244	-0.3685	TO 12.1685
FRANKLIN	506	-2.5011	51.3572	2.2831	-153.8750	280.8523	-6.9867	TO 1.9844
MALCOLM X	445	0.8297	52.2719	2.4779	-114.5256	226.0903	-4.4002	TO 5.6996
LONGFELLOW	650	-0.5978	45.6317	1.7898	-170.6416	184.1064	-4.1124	TO 2.9167
TOTAL	2014	0.5031	52.8247	1.1771	-170.6416	331.2244	-1.8053	TO 2.8116

Table 139. Reading and Mathematics Achievement by School for Grades Seven to Nine.

Raw Gain Reading									
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT FOR MEAN	
ODYSSEY	16	-57.1875	96.2152	24.0538	-248.0000	62.0000	-108.4569	TO	-5.9181
KING	946	6.6173	55.2192	1.7953	-340.0000	201.0000	3.0940	TO	10.1406
WILLARD	644	1.7096	55.3153	2.1797	-383.0000	189.0000	-2.5706	TO	5.9899
WEST CAMPUS	522	31.0709	95.3559	4.1736	-927.0000	248.0000	22.8717	TO	39.2701
TOTAL	2128	10.6508	68.8520	1.4926	-927.0000	248.0000	7.7238	TO	13.5779
Residual Gain Reading									
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT FOR MEAN	
ODYSSEY	16	-72.5440	88.6117	22.1529	-225.5083	49.1277	-119.7618	TO	-25.3262
KING	946	1.9750	54.2209	1.7629	-310.1926	174.7283	-1.4846	TO	5.4346
WILLARD	644	-2.7128	54.7699	2.1582	-365.0925	154.8735	-6.9508	TO	1.5252
WEST CAMPUS	522	12.6367	93.3671	4.0866	-899.1235	232.0217	4.6085	TO	20.6648
TOTAL	2128	2.6114	66.9297	1.4509	-899.1235	232.0217	-0.2339	TO	5.4567
Raw Gain Math									
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT FOR MEAN	
ODYSSEY	7	-13.5714	74.0064	27.9718	-116.0000	84.0000	-82.0155	TO	54.8726
KING	960	20.3646	51.4602	1.6609	-172.0000	230.0000	17.1052	TO	23.6239
WILLARD	624	16.9359	45.1612	1.8079	-121.0000	192.0000	13.3856	TO	20.4862
WEST CAMPUS	584	26.4709	53.5607	2.2164	-511.0000	273.0000	22.1179	TO	30.8239
TOTAL	2175	20.9113	50.5357	1.0836	-511.0000	273.0000	18.7863	TO	23.0362
Residual Gain Math									
GROUP	COUNT	MEAN	STANDARD DEVIATION	STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF	INT FOR MEAN	
ODYSSEY	7	-41.5077	66.4249	25.1062	-145.6968	27.6169	-102.9401	TO	19.9246
KING	960	-1.8939	49.2122	1.5883	-210.8967	210.7749	-5.0109	TO	1.2230
WILLARD	624	-3.9566	43.3915	1.7370	-166.9119	159.0830	-7.3677	TO	-0.5454
WEST CAMPUS	584	6.1982	51.9140	2.1482	-520.1228	247.2068	1.9790	TO	10.4173
TOTAL	2175	-0.4404	48.6266	1.0427	-520.1228	247.2068	-2.4851	TO	1.6043

Table 140. Reading and Mathematics Achievement by School for Grade Ten.

Raw Gain Reading				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION				-	+
EAST CAMPUS	20	0.8060	77.0615	17.2315	-142.0000	186.0000	-35.2658	TO 36.8658
B.H.S.	134	23.7537	59.3321	5.1255	-240.0000	257.0000	13.6157	TO 33.8918
TOTAL	154	20.7727	62.1089	5.0049	-240.0000	257.0000	10.8851	TO 30.6603
Residual Gain Reading				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION				-	+
EAST CAMPUS	20	-15.4037	79.8143	17.8470	-129.0085	163.1772	-52.7579	TO 21.9504
B.H.S.	134	2.3959	55.6423	4.8068	-218.5266	200.6951	-7.1117	TO 11.9035
TOTAL	154	0.0843	59.3167	4.7799	-218.5266	200.6951	-9.3588	TO 9.5273
Raw Gain Math				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION				-	+
EAST CAMPUS	12	-1.5000	140.3615	40.5189	-141.0000	401.0000	-90.6813	TO 87.6813
B.H.S.	96	25.1042	52.2114	5.3288	-103.0000	309.0000	14.5252	TO 35.6832
TOTAL	108	22.1481	67.2030	6.4666	-141.0000	401.0000	9.3289	TO 34.9674
Residual Gain Math				STANDARD ERROR	MINIMUM	MAXIMUM	95 PCT CONF INT FOR MEAN	
GROUP	COUNT	MEAN	STANDARD DEVIATION				-	+
EAST CAMPUS	12	-22.6282	131.5390	37.9720	-126.9329	371.1892	-106.2039	TO 60.9475
B.H.S.	96	2.7087	44.2321	4.5144	-115.1587	192.0833	-6.2535	TO 11.6710
TOTAL	108	-0.1065	59.8316	5.7573	-126.9329	371.1892	-11.5197	TO 11.3067

well as the Berkeley High School students who took the CTBS tests.

With the notable exception of the Early Learning Center, the off-site ESP schools represent particularly difficult problems of interpretation. Kilimanjaro, since it is a 1-6 grade school, was included in both grade groups according to the grade of the student. In grade group 1-3, virtually no scores were available. While the two students in the reading analysis did very well, there is no variance. Evidently, the analytic method is robust enough to deal with this problem, the 95% confidence interval is (6.4, 298.6) for raw gain reading, and Kilimanjaro was not selected as an above-average school. The scores in the math analysis are more reasonably distributed. For the Kilimanjaro students in the 4-6 grade group, while the numbers are again very small, the distributions are reasonable and Kilimanjaro means are the lowest in the group on all measures. Because of the small sample size, however, this is significant only for the raw gain math measure.

Odyssey is far below the other 7-9 grade group schools on all measures. While relatively few scores were available for the Odyssey analysis, a supplementary examination of 40 additional spring scores supported the analytic findings.

Despite the small sample size, their differences are significant for both reading measures. The small numbers did prevent the math differences from being significant. This small number is due to the fact that the ninth grade math tests were never found.

While the identified schools are significantly above or below the norm, a detailed examination of Tables 137 to 140 reveals that the differences are not large in terms of standard deviations and that all schools, except Odyssey, are within one-half standard deviation of the mean on all measures. No school with an adequate testing program need be singled out as doing clearly better or worse than another.

The other significant result that should be noted is the similarity of outcome across measures of achievement. This suggests that the schools are sufficiently homogenous as to student characteristics and skills as to make raw gain a valid measure of achievement. This should be considered in future evaluation studies.

In addition to the school results, a similar analysis was performed for the Follow Through and Compensatory Education Programs. For the Follow Through Program, of the 842 students identified as in the program, there were 315 residual gain scores for reading and 498 for math, with mean scores of -3.01

and -4.03 respectively. These means were not significantly different at the .05 level from those for non-Follow Through students.

For the Compensatory Education Program, 617 of the 1,384 Compensatory Education students had residual gain scores for reading and 835 has residual gain scores for math. The reading residual gain mean was -7.69, and the math residual gain mean was -6.09. While these differences are significantly different at the .05 level, the differences in terms of deviation scores is again very small.

The interpretation and importance of differences is not clear. The differences reported could reflect analytic limitations in the procedures used (e.g., unequal variance), actual differences, or differences due to sampling bias. In general, it is not possible to give definite conclusions as to the extent of these problems.

- Summary -- The primary finding of the school effectiveness study was the identification of small, but statistically significant, differences among schools. Differences between Compensatory Education and non-Compensatory Education programs were similarly small but statistically significant, with higher achievement for the non-Compensatory Education program. No

significant differences were found in the comparison between Follow-Through and non-Follow-Through programs.

The degree of confidence in these findings varies with the percentage of participating students. Thus, where the proportion of students included in the analysis is small (i.e., where insufficient data were available), there is concern that the findings may not reflect the true situation. While some measure of uncertainty attaches to all of the data (since there is neither 100% participation, nor concrete evidence that students participating in the study were totally representative), the finding of statistically significant differences among schools is noteworthy.

Impact of Student, Classroom, and School Variables on Achievement: Educational Impact Study

- Analytic Approach -- The purpose of the impact analysis was to determine the impact of classroom and school process variables on the reading and mathematics achievement. These variables were defined and measured by Pacific Consultants during the process study and then linked to student records. Here, unlike the school analysis in the preceding section, spring 1975 CTBS reading and math scale scores were used directly as the measure of achievement. A regression model was used to describe the relationship of student characteristics and process variables to student achievement.

In using the regression model to predict achievement on the basis of student characteristics and classroom process variables, it was first determined how well achievement could be predicted by student characteristics and skills, how much variation in achievement could be explained by these variables, then how much better prediction, how much more variation, could be explained using the addition of the process variables.

The equations may suggest treatments to improve achievement. The values of the process variables which predict the highest achievement, the "best"

values, and the values of the process variables which predict the lowest achievement, the "worst" values, can be examined to see if a conceptually sound treatment is suggested. No causal relationship between process variables and achievement should be implied, however.

Technically, a forward stepwise procedure was used in the regression. First, the variable that best explained achievement was used -- this was always the fall test score -- then the best explainer among the student variables, etc. Then, all the student variables were added to the equation one at a time in an attempt to explain additional variance in achievements.

As the purpose of this analysis was to connect school and classroom variables to students, the analysis was restricted to the elementary grades where a student actually has a classroom and identifiable teachers, and to students who could be linked to classrooms observed by Pacific Consultants. Of the 5,003 records for elementary students, 3,824, or 76%, were linked to classrooms observed by Pacific Consultants and were used in the classroom impact analysis. Separate analyses were again performed for mathematics and for reading and for grade groups one to three and four to six. For the reading analysis,

there were 920 students in grade groups one to three and 1,266 cases in grade groups four to six. In the mathematics analysis, there was 1,389 cases in grade groups one to three and 1,193 cases in grade groups four to six.

Initially, the classroom variables included the I-Scale score, the Teachers Survey - Part II (DISC total and Items 29 to 32 separately)* and the percentage of Blacks in the classroom as observed by Pacific Consultants. The only school variable included was the ESP, non-ESP indicator. The student variables were the same as those in the school achievement analysis. Interactions between the I-Scale score and Models of Individualization were also included.

On the basis of preliminary analysis, a number of changes were made in the variables used. Observed percentage of Black students in classrooms appeared to interact with the ethnicity variables enough to cause problems of interpretation and was eliminated. Models of Individualization 1 and 2 were combined and contrasted to Model 5.* Because of the experimental nature of the items added to the Teacher Survey (Items 29 to 32), and the difficulties in ranking the

*See pages 46, 60 and 427 for an explanation of these instruments and findings obtained with them in the process study.

middle responses to each item, they were originally treated as nominally scaled, and dummy variables were generated for each response category. This did not permit adequate interpretation of the results, however, and in the model reported, Items 29 to 32 are treated as ordinally scaled variables. A high score on Items 30 and 31 represents an open response. *Vice versa*, a high score for Items 29 and 32 represents a closed response.

ESP participation was found to be completely non-predictive and was therefore removed from the equation. Because of the importance and difficulty in looking at ESP programs, however, a side study was conducted. The students in this sub-study were identified as ESP if they were linked to an observed classroom designated as ESP. The distribution of students by grade is shown below:

GRADE	NUMBER ESP STUDENTS
1	64
2	171
3	105
4	33
5	45
6	81

The four achievement measures used for the school analysis were again used (raw gain reading, residual gain reading, raw gain math, residual gain

math), and T-tests were performed by grade group to see if ESP and non-ESP students differed on these measures. In six out of eight comparisons, no significant differences were found: for grade group 1-3, there were no significant differences between ESP and non-ESP students in either math or reading; for grade group 4-6, the math measures were not significantly different, but ESP students were found to be significantly lower on both reading measures.

- Results -- In general, the classroom variables which were included in the present study (i.e., individualization and degree of openness) did not have an impact on student achievement. In all cases, these variables explained less than 2% of the variation in student achievement. While several variables did occur in more than one equation, the equations do not suggest the presence of treatments that are effective enough to increase achievement. The data are summarized by the correlation matrices presented in Tables 141 and 142.

Some of the analytic difficulties in showing impact are apparent from these tables. For reading in grade group four to six, for example, the correlation between the fall and spring reading scores is .869, and 75.6% of the variation in achievement can be accounted for by fall score. The correlations between

Table 141. Correlation Matrices for Reading Variables.

Grade 1-3																	N = 920
VAR 02	0.850																
VAR 03	0.448	0.414															
VAR 04	0.346	0.239	0.136														
VAR 05	-0.401	-0.353	0.095	-0.831													
VAR 06	0.492	0.439	-0.023	0.961	-0.798												
VAR 07	0.769	0.810	0.849	0.081	-0.146	0.260											
VAR 08	-0.079	-0.079	-0.151	0.005	0.028	-0.000	-0.128										
VAR 09	0.010	0.011	0.020	-0.025	-0.007	-0.025	0.039	-0.623									
VAR 10	0.018	0.016	0.062	-0.041	0.009	-0.043	0.054	-0.778	0.801								
VAR 11	0.005	0.002	-0.040	0.039	0.009	0.042	-0.018	0.912	-0.682	-0.852							
VAR 12	-0.080	-0.055	-0.126	-0.010	0.009	-0.030	-0.096	0.231	0.742	0.289	-0.389						
VAR 13	-0.054	0.010	0.064	-0.074	0.027	-0.076	0.036	-0.066	-0.055	0.025	0.003	-0.174					
VAR 14	0.057	0.019	0.048	0.023	-0.026	0.029	0.043	0.221	-0.091	-0.193	0.154	-0.018	0.014				
VAR 15	-0.006	-0.023	-0.006	-0.019	0.017	-0.016	-0.022	0.090	-0.208	-0.166	0.192	0.125	0.190	-0.343			
VAR 16	-0.038	-0.015	0.023	-0.058	0.041	-0.066	0.007	-0.261	0.306	0.346	-0.296	0.149	0.076	-0.262	0.069		
VAR 17	0.091	0.010	0.119	0.087	-0.062	0.078	0.107	-0.132	0.023	0.088	-0.192	0.038	-0.160	0.216	-0.001		
VAR 01																	
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LEGEND

Student Variables

VAR 01 - Spring

Grade 1-3		Grade 4-6		Grade 7-9		Grade 10-12		Grade 13-15		Grade 16-18		Grade 19-21		Grade 22-24		Grade 25-27		Grade 28-30		Grade 31-33		Grade 34-36		Grade 37-39		Grade 40-42		Grade 43-45		Grade 46-48		Grade 49-51		Grade 52-54		Grade 55-57		Grade 58-60		Grade 61-63		Grade 64-66		Grade 67-69		Grade 70-72		Grade 73-75		Grade 76-78		Grade 79-81		Grade 82-84		Grade 85-87		Grade 88-90		Grade 91-93		Grade 94-96		Grade 97-99		Grade 100-102		Grade 103-105		Grade 106-108		Grade 109-111		Grade 112-114		Grade 115-117		Grade 118-120		Grade 121-123		Grade 124-126		Grade 127-129		Grade 130-132		Grade 133-135		Grade 136-138		Grade 139-141		Grade 142-144		Grade 145-147		Grade 148-150		Grade 151-153		Grade 154-156		Grade 157-159		Grade 160-162		Grade 163-165		Grade 166-168		Grade 169-171		Grade 172-174		Grade 175-177		Grade 178-180		Grade 181-183		Grade 184-186		Grade 187-189		Grade 190-192		Grade 193-195		Grade 196-198		Grade 199-201		Grade 202-204		Grade 205-207		Grade 208-210		Grade 211-213		Grade 214-216		Grade 217-219		Grade 220-222		Grade 223-225		Grade 226-228		Grade 229-231		Grade 232-234		Grade 235-237		Grade 238-240		Grade 241-243		Grade 244-246		Grade 247-249		Grade 250-252		Grade 253-255		Grade 256-258		Grade 259-261		Grade 262-264		Grade 265-267		Grade 268-270		Grade 271-273		Grade 274-276		Grade 277-279		Grade 280-282		Grade 283-285		Grade 286-288		Grade 289-291		Grade 292-294		Grade 295-297		Grade 298-300		Grade 301-303		Grade 304-306		Grade 307-309		Grade 310-312		Grade 313-315		Grade 316-318		Grade 319-321		Grade 322-324		Grade 325-327		Grade 328-330		Grade 331-333		Grade 334-336		Grade 337-339		Grade 340-342		Grade 343-345		Grade 346-348		Grade 349-351		Grade 352-354		Grade 355-357		Grade 358-360		Grade 361-363		Grade 364-366		Grade 367-369		Grade 370-372		Grade 373-375		Grade 376-378		Grade 379-381		Grade 382-384		Grade 385-387		Grade 388-390		Grade 391-393		Grade 394-396		Grade 397-399		Grade 400-402		Grade 403-405		Grade 406-408		Grade 409-411		Grade 412-414		Grade 415-417		Grade 418-420		Grade 421-423		Grade 424-426		Grade 427-429		Grade 430-432		Grade 433-435		Grade 436-438		Grade 439-441		Grade 442-444		Grade 445-447		Grade 448-450		Grade 451-453		Grade 454-456		Grade 457-459		Grade 460-462		Grade 463-465		Grade 466-468		Grade 469-471		Grade 472-474		Grade 475-477		Grade 478-480		Grade 481-483		Grade 484-486		Grade 487-489		Grade 490-492		Grade 493-495		Grade 496-498		Grade 499-501		Grade 502-504		Grade 505-507		Grade 508-510		Grade 511-513		Grade 514-516		Grade 517-519		Grade 520-522		Grade 523-525		Grade 526-528		Grade 529-531		Grade 532-534		Grade 535-537		Grade 538-540		Grade 541-543		Grade 544-546		Grade 547-549		Grade 550-552		Grade 553-555		Grade 556-558		Grade 559-561		Grade 562-564		Grade 565-567		Grade 568-570		Grade 571-573		Grade 574-576		Grade 577-579		Grade 580-582		Grade 583-585		Grade 586-588		Grade 589-591		Grade 592-594		Grade 595-597		Grade 598-600		Grade 601-603		Grade 604-606		Grade 607-609		Grade 610-612		Grade 613-615		Grade 616-618		Grade 619-621		Grade 622-624		Grade 625-627		Grade 628-630		Grade 631-633		Grade 634-636		Grade 637-639		Grade 640-642		Grade 643-645		Grade 646-648		Grade 649-651		Grade 652-654		Grade 655-657		Grade 658-660		Grade 661-663		Grade 664-666		Grade 667-669		Grade 670-672		Grade 673-675		Grade 676-678		Grade 679-681		Grade 682-684		Grade 685-687		Grade 688-690		Grade 691-693	
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Student Variables		Classroom Variables			
VAR 01 - Spring Math Score	VAR 05 - Black	VAR 08 - I-Scale/Model 5 Interaction	VAR 11 - Model 5		
VAR 02 - Fall Math Score	VAR 06 - Fall Math/White Interaction	VAR 09 - I-Scale/Model 1 or 2 Interaction	VAR 12 - I-Scale		
VAR 03 - Grade	VAR 07 - Fall Math/Grade Interaction	VAR 10 - Model 1 or Model 2	VAR 17 - DISC Total		
VAR 04 - White		VAR 13 to VAR 16 - Item 29 to Item 32			

spring scores and the student variables are all high, the lowest being .324 for grade. The correlations between spring scores and the classroom variables are very low, the highest being .111 for the interaction between I-Scale and Model of Individualization 5.

The percent variation in student achievement explained by the regression model as a function of the variables in the model is presented in Table 143.

Table 143. Percent of Variance Explained by the Impact Models.

Variables Added	Reading		Math	
	Grades 1-3	Grades 4-6	Grades 1-3	Grades 4-6
Fall Test	72.32	75.57	74.70	63.62
Student Variables	76.98	78.20	77.01	69.48
Selected Classroom Variables	77.62	78.50	77.64	70.65
All Classroom Variables	77.85	78.91	77.72	71.18

For each model, the selection of classroom variables, the cutoff point in the regression, is discussed below. But, as can be seen from the table, the results are not made significantly different by allowing all of the variables to enter the equations. The percent

of variance explained by the selected classroom variables varies from 1.17 for math in grade group four to six to .27 for reading in grade group four to six. The contribution to the reduction in variance for the last of the selected variables ranged from .12% for math in grade group four to six and reading in grade group one to three to .03% for reading in grade group four to six.

The selection of the variables to be used, the decision of when in the regression process to stop adding variables, was made on the following basis. Variables were included as long as the difference in the increase in variance explained continued to decrease, or until an interaction term entered the equation. This procedure was designed to minimize problems of interpretation. Four variables were selected except for the analysis of reading in grade group one to three where the fourth variable would have been I-Scale/Model 5 interaction. The classroom variables selected and their coefficient in the equation are presented in Table 144.

Table 144. Selected Classroom Variables and Their Regression Coefficients.

Reading		Math	
Grades 1-3	Grades 4-6	Grades 1-3	Grades 4-6
Item 29 -4.23	Item 32 -7.23	I-Scale -.55	DISC +3.81
I-Scale -.55	Item 31 -3.67	Item 30 -3.64	Item 32 -8.30
Item 30 -4.51	Item 29 +1.92	DISC -1.00	I-Scale -.87
	Model 12 +4.31	Item 29 -1.21	Model 12 +9.39

Since none of the classroom process variables were statistically significant in explaining variation in achievement, other values such as consistency and conceptual validity were considered. Both I-Scale and DISC total came into both math equations, and this is the only consistency within either reading or math. While Item 29 came into both reading equations, it came in with opposite signs in the two grade groups. This suggests a lack of conceptual validity and that its occurrence was due to chance (sampling variation). I-Scale and Item 29 are in both of the one to three grade group equations, but again with the opposite sign in each. The four to six grade group equations have only Item 32 in common. The consistency across equations is slight.

Model 5, the traditional classroom model, does

not enter into any of the equations, and Model $1/2$ enters at the last step in both four to six grade group equations. This suggests that the Models of Individualization are not useful in explaining achievement in the data.

The I-Scale score entered three of the equations, each time with a negative sign. This negative sign means that the more individualized the classroom, the lower the mean achievement predicted for that student. When the signs of other variables that measure individualization and openness are examined, no consistent pattern emerges. A high score on Item 29 represents closed or standardized student evaluation; hence, a negative sign suggests that more individualized evaluation correlates positively with achievement. Item 29 occurs twice with a negative sign and once with a positive sign. Item 30 also occurs with different signs. For Item 31, a high score represents an open educational approach, and it enters once with a negative sign. For Item 32, a high score represents a closed educational approach, and it enters twice with a negative sign.

As a guide to treatment, to improving achievement, the equations are not satisfactory. Except in the case of the math equation for grade group four to six, the difference in scale score predicted between

the "worst" values of the classroom variables and the "best" values is less than 50 scale points, and consistent conceptual interpretation is not possible.

For the four to six grade group math equation, the difference in predicted score is 160 scale points between the "best" and "worst" values of the process variables. Again, however, conceptually the equation does not lead to reasonable conclusions. The DISC score and I-Scale score, for example, occur in the equation with opposite signs, and suggest sampling variation rather than effective impact.

- Summary -- In the educational effectiveness study, reading and math achievement scores for elementary school children were analyzed in relation to measures of classroom openness and individualization. Using a regression model to identify the amount of variance in achievement which was attributable to student skill, student characteristics, and to these identified classroom variables, it was found that:

- 70% of the variance was explained by starting skill, as measured by the fall test results.
- 1% was explained by student characteristics.
- Less than 2% of the variance was attributable to classroom variables, and, even here, the findings were inconsistent.

In sum, the results show no measurable, systematic impact attributable to the extent of openness and/or individualization.

Several possible implications may be derived from this finding: First, it is possible that the variation in degree of openness and individualization among classrooms was insufficient to produce a measurable result; i.e., virtually no classrooms were found to be both highly open and highly individualized so that there was no opportunity to test the effect that such a classroom situation might have had. Second, the state of the art is such that our instruments and/or evaluation strategy may not have been sufficiently sensitive to identify impact. And third, the finding of no impact may simply reflect the fact that the classroom variables under study did not impact student achievement.

The finding that classroom variables have no impact on achievement is not unexpected. Indeed, it is consistent with the results of a number of major studies of the effects of educational variables on student outcomes. For instance, the renowned Coleman report (1966) found that, "... variations in the facilities and curriculums of the schools account for relatively little variation in pupil achievement insofar as this is measured by standard tests."

Coleman's data showed that, across the years of a child's school experience, family background was the most important factor in determining pupil achievement, and that the only school characteristic which had even a minimal effect on achievement was the nature of the student body. Similar conclusions were reached by Heath and Nielson (1974) in a survey of research on 11 dimensions of teacher effectiveness. They concluded, "In our opinion, an analysis of the research on the relation between specific teacher skills and student achievement fails to reveal an empirical basis for performance-based teacher education." In another appraisal of research on school effects, Averch and others of Rand Corporation (1972) stated that, "The best information we have ... is that schools do not now have a tremendous impact on the achievement that does occur."

In the B.U.S.D. Evaluation Study, as in those reported above, the classroom variables did not affect the achievement growth of Berkeley school children. Rather, the achievement growth was almost entirely accounted for by the personal and skill characteristics that the students brought to the classroom in the fall. Nonetheless, because we firmly believe that exemplary classroom practices can impact achievement, it is suggested that the concerns voiced

by B.U.S.D. parents, teachers, students, and administrators, the descriptions of basic skills curricula, and of the instructional methodology in B.U.S.D. as presented in the process study, be reviewed as sources of input and guidance for educational innovation in B.U.S.D.

SUMMARIZED CONCLUSIONS -- IMPACT STUDY

Reading and Mathematics Achievement in
B.U.S.D.: School Effectiveness Study

Impact of Student and Classroom Variables
in Achievement: Educational Impact
Study

VI. SUMMARIZED CONCLUSIONS - IMPACT STUDY

Analyses in this volume were based on achievement test results for the 1974-1975 school year furnished by B.U.S.D. All students who took both fall 1974 and spring 1975 CTBS (California Tests of Basic Skills) tests were included. Kindergarten, Eleventh, and Twelfth grade students were excluded because of incompatible testing procedures. A total of 8112 students were used in the analysis. Examination of the data showed:

- B.U.S.D. students consistently scored above the national norms, wherever such comparisons were appropriate.
- Supplementary analysis of the COOP test results at the high school level showed highly significant ethnic bias as to which test was used. 80% of the high school students who took the CTBS tests were Black. 30% of those who took the COOP tests were Black. These biases indicate that aggregated scores obtained at the high school level should not be compared with national norms.

- Participation of some schools and programs in the testing program was very low. This was particularly true of ESP (Experimental School Program) and makes conclusions about the effectiveness of ESP very difficult.

Reading and Mathematics Achievement in B.U.S.D.: School Effectiveness Study

Schools and programs were compared within grade groups on four achievement measures: raw gain (spring score minus fall score) and residual gain for reading and mathematics. Residual gain measures are constructed on the basis of a regression model and are used to control for student characteristics and skill. The analysis of these measures showed:

- There were statistically significant differences between the gain scores of the various B.U.S.D. schools. These differences are small in size and may not reflect actual differences in schools. They may, for example, be due to the non-representativeness of the students tested.
- Of the off-site ESP schools, only Early Learning Center had an acceptable number of fall/spring test scores. Early Learning was above average on

the math measures. This was the only positive effect of an ESP school seen in any of the analyses.

- Odyssey was the only school with scores which were considerably below the average, particularly in reading. While there were relatively few fall/spring scores for Odyssey students, a supplementary analysis of spring-only scores supported the negative finding.
- The difference between the average reading and mathematics gain of Follow Through students and non-Follow Through students was not statistically significant (at the .05 level).
- The average reading and mathematics gain of Compensatory Education students was significantly lower than that of other students. These differences, while statistically significant, were very small.

Impact of Student and Classroom Variables in Achievement:
Educational Impact Study

The elementary students that could be linked to classroom variables observed by Pacific Consultants were used in an analysis of the impact of classroom variables on achievement. This analysis showed:

- Classroom variables did not have an impact on student achievement. These variables explained less than 2% of the variation in student's reading and mathematics achievement.
- 70% of the variation in achievement was explained by starting skill, as measured by the fall test results.
- An additional 4% was explained by student characteristics such as ethnicity.

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